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Vector Control Bulletin No. 1 (Revised) January 1979

Montana Mosquitoes

Part 1: Identification and Biology

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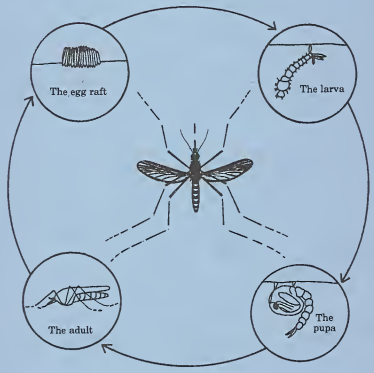

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ACKNOWLEDGEMENT

This bulletin is essentially a revised form of Mosquitoes of Montana by G. Allen Mail (1934). It has been somewhat updated and revised principally by referring to Mosquitoes of North America by Carpenter and LaCasse (1955). This bulletin liberally includes appropriate information from: Mosquitoes of Public Health Importance and Their Control by Pratt and Littig (1971), Identification Keys for Common Mosquitoes of United States by Pratt and Barnes (1959), Mosquitoes of Colorado by Harmston and Lawson (1967), The Mosquitoes of Minnesota by A. R. Barr (1958), and Mosquitoes of Indiana by R. E. Siverly (1972).

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INTRODUCTION

Mosquito abatement and other public health personnel in Montana may be called upon to combat the deleterious effects of particular mosquitoes. Knowledge about the breeding habitats and habits of the species involved will assist them in the conduct of their duties. It is intended that this bulletin will assist these personnel in determining what species are located in their area and what their effects might be.

There have been 46 species of mosquitoes reported in Montana distributed among six genera as: Aedes, 31 species; Anopheles, 3 species; Culex, 4 species; Culiseta, 6 species; Coquillettidia,1 species; and Psorophora, 1 species. The different species do not assume equal importance due to a variety of factors including difference in abundance, distribution, and feeding habits. Some species can act as vectors (spread a disease); some are highly annoying to man and livestock and are of economic importance in Montana. Reliable quantitative data on the latter point is difficult to obtain. In estimating impact, Mail (1934) stated that milk production could be reduced by 30 to 40 percent. Research has demonstrated a statistically significant mosquito caused reduction in average daily weight gain of Hereford steers that would have cost ranchers $4.20 per head in 1971 and $6.85 per head in 1972. It should be noted however, that reduced weight gain in cattle varies with the number and type of mosquitoes as well as breed of cattle and their nutritional levels. Other economic losses such as those due to costs of medicines and repellants, reduced tourism and otherwise restricted outdoor activities of man have not been estimated.

Mosquitoes pass through a series of developmental stages from eggs to larvae to pupae to adults. The first three stages of development require water. Within this developmental pattern, there are four larval stages interspersed by molts in which the larvae "shed their skin". The time required for development and the number of generations produced each year depend on species differences, water temperatures, the availability of food and, in some cases, the number of times the eggs are flooded or irrigated.

Each species possesses a particular set of physical characteristics as noted on the included figures (pages 2, 3, 10, and 11). Species may be identified by using classification keys for fourth stage larvae (pages 4 to 9) or adult females (pages 12 to 17). Complete species descriptions and keys for classification of adult males have not been included in this bulletin but may be obtained by consulting such texts as Mosquitoes of North America by Carpenter and LaCasse. The non-biting adult males have very bushy antennae and palpi which are nearly as long as the proboscis which distinguishes them from the adult female with her short palpi (except for Anopheles sp.) and more sparsely haired antennae.

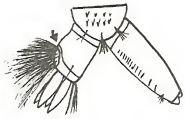
Figure 1.

LARVAL CHARACTERS USED IN CLASSIFICATION TO GENUS

AEDES

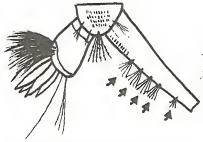
Saddle not ringing anal segment;

AEDES



or, if saddle rings anal segment, tufts of ventral brush do not penetrate saddle

CULEX



Multiple ventral tufts on siphon

CULISETA

Basal tuft on siphon

ANOPHELES

Respiratory siphon absent

PSOROPHORA

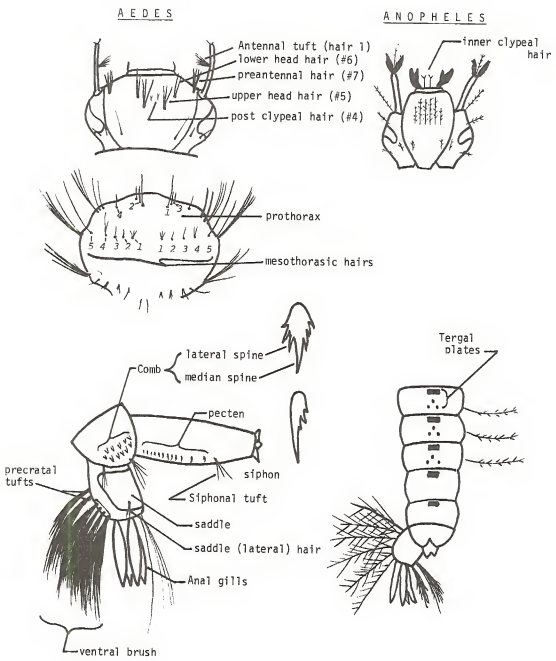
Saddle rings anal segment and is pierced by tufts of ventral brush

COQUILLETTIDIA

Siphon pointed, hardened; adapted for penetrating plant stems.

Figure 2.

LARVAL CHARACTERISTICS



KEY TO MOSQUITO LARVAE OF MONTANA*

Key to Montana Genera of Fourth Stage Larvae

1. Air tube present 2
   Air tube absent ..... Anopheles

2. Pecten absent; air tube short, conical, sharply pointed ..... Coquillettidia
   Pecten present; air tube not sharply pointed 3

3. Air tube with a pair of tufts near base ..... Culiseta
   Air tube without a pair of tufts near base 4

4. Air tube with several pairs of tufts or single hairs ..... Culex
   Air tube with not more than one pairs of tufts 5

5. Anal segment ringed by sclerotized plate and pierced by tufts of the ventral brush ..... Psorophora
   Anal segment not completely ringed by sclerotized plate, or if ringed, the ventral brush does not pierce the plate ..... Aedes

Key to Montana Species of Fourth Stage Anopheles Larvae

1. Inner clypeal hairs bare 2
   At least one inner clypeal hair with two or more branches near middle ..... A. earlei

2. Abdominal segments IV - VI with two dorsal (tergal) plates ..... A. punctipennis
   Abdominal segments IV - VI with three small tergal plates behind one larger tergal plate ..... A. freeborni

Key to Montana Species of Fourth Stage Aedes Larvae

1. Anal segment ringed by anal plate (saddle)..... 2
   Anal segment not completely ringed by saddle 5

2. (1) Pecten teeth nearly uniformly spaced 3
   Last 2-4 pecten teeth more widely spaced ..... nigromaculis

3. (2) Comb scale patch with 10 or more scales 4
   Comb scale patch with 4-9 individual scales ..... hexodontus

* Modified from Mail (1934) Mosquitoes of Montana, Bulletin 288, Montana State College Agriculture Experiment Station; S.J. Carpenter and W.J. LaCasse (1955) Mosquitoes of North America, University of California Press, 360 pp. 127 plates; H.D. Pratt and R.C. Barnes (1959) CDC Training Guide "Identification Keys for Common Mosquitoes of United States" 40 pp.; F.C. Harmston and F.A. Lawson (1967) Mosquitoes of Colorado, 140 pp.

4. (3) Upper and lower head hairs single; 17-26 comb scales; lateral spinules ½ as long as median spine on comb scale ..... trivittatus
Upper and lower head hairs single or double; 10-19 comb scales; comb scales with weak lateral spinules ..... punctor

5. (1) Last pecten teeth more widely spaced 6
Pecten teeth nearly uniformly spaced 19

6. (5) Tuft on siphon within the pecten 7
Tuft on siphon outside the pecten 8

7. (6) Several dorsal hair tufts on siphon ..... provocans
No dorsal tufts on siphon ..... cataphylla

8. (6) Antennae shorter than head 9
Antennae at least as long as head ..... dianteus

9. (8) Upper or lower head hairs single 10
Upper and lower head hairs branched 13

10. (9) Siphon about 5x1; mesothorasic hair No. 1 double or multiple and less than 1/3 antennal length (in part, occasional) ..... excrucians
Siphon less than 4x1 11

11.(10) Upper and lower head hairs usually single (occasionally upper or lower double) 12
Upper head hair 2 or 3 (rarely 4) branched, lower head hair single (occasionally double); 19-33 comb scales broadly rounded with subequal spinules; mesothorasic hair No. 1, 2-4 branched and as long as antennae ..... (in part) ..... campestris

12.(11) Seven to 13 (gen.8-9) comb scales; comb scale lateral spinules weak, median spine long ..... spencerii
Thirteen to 29 (gen.14-18) comb scales; comb scale lateral spinules prominent ..... idahoensis

13.(9) Eighteen or more comb scales 14
Seventeen or fewer comb scales 16

14.(13) Siphon 5x1; usually two upper head hairs (occasionally 1 or 3) and two lower head hairs; mesothorasic hair No. 1 double or multiple and less than 1/3 antennal length ..... (in part) ..... excrucians
Siphon less than 4x1 15

15.(14) Pecten reaching middle of siphon; gills shorter than anal segment; mesothorasic hair No. 1 2-4 branched and as long as antennae .(in part). campestris
Pecten not reaching middle of siphon; gills longer than anal segment; mesthorasic hair No. 1 multiple and less than ½ antennal length..(in part)..... flavescens

16.(13) Upper head hairs with 3 or more branches 17
Upper and lower head hairs usually double (occasionally upper and lower triple); 6-9 comb scales ..... riparius

17.(16) Bases of upper and lower head hairs in line with head hair #7; 5-9 upper and 4-8 lower head hairs; 9-16 comb scales ..... cinereus
Bases of upper, lower, and head hair #7 not forming a straight line 18

18. (17) Tuft on siphon about as long as diameter at base; 12-16 comb scales; mesothorasic hair No. 1 multiple and less than 1/2 antennae length ..... intrudens
Tuft on siphon rarely 1/2 as long as diameter at base; 9-12 comb scales..... vexans

19. (5) Antennal hair 1 single, small 20
Antennal hair 1 double or multiple 21

20. (19) Eight to twelve long, gradually tapered evenly fringed comb scales; siphon tuft of 1 or 2 hairs ..... hendersoni
Sixteen to twenty-four comb scales ..... sierrensis

21. (19) Upper and lower head hairs usually single (occasionally double) 22
Upper and lower head hairs usually multiple (upper 3 or more, lower 1 to multiple) 30

22. (21) Eight to sixteen comb scales with lateral spinules less than 1/2 as long as median spine ..... impiger
Generally more than 16 comb scales 23

23. (22) More than 40 comb scales ..... communis
Less than 39 comb scales 24

24. (23) Mesothorasic hair No. 1 single to triple and about as long as antennae 25
Mesothorasic hair No. 1 single to triple and usually less than 1/2 antennal length 26

25. (24) Upper head hairs single, occasionally double; pecten not extending beyond middle of siphon, last tooth not longer or stronger than preceeding teeth; siphonal tuft 4-8 haired; 20-25 comb scales ..... dorsalis
Upper head hairs double or triple; pecten extending about 3/5 length of siphon, last two teeth longer and stronger, usually detached ..... (in part) ..... campestris

26. (24) Mesothorasic hair No. 1 single and about 1/2 antennal length 27
Mesothorasic hair No. 1 single to triple and less than 1/3 antennal length 29

27. (26) Hind margin of saddle fringed with conspicuous microsetae (hairs); upper head hairs double or triple, lower head hairs single or double; siphonal tuft 3-7 haired, siphon 3.0-3.5x1; comb scales with median spine less than 1½ x as long as lateral spines ..... increpitus
Hind margin of saddle not fringed; upper head hairs single or double; median spine of comb scales 1½ x as long as largest lateral spinules 28

28. (27) Upper head hairs usually single (occasionally double); lower head hair single; head hair No. 4 small, usually single; siphonal tuft 3 branched (occasionally 2 or 4); siphon 2.5-3.0 x 1 ..... implicatus
Upper head hairs usually double (occasionally 1 or 3), lower head hairs single (rarely double); head hair No. 4 small, branched; siphonal tuft 3 or 4 branched; siphon 3.0-4.0 x 1 (general 3.5 x 1 or longer)..... mercurator

29. (26) Anal gills usually about 1/2 as long as saddle; upper and lower head hairs usually single (occasionally one or both double)..... melanimon
Anal gills usually twice as long as saddle; upper head hairs usually 2-4 branched (rarely single); lower head hairs double (sometimes 1-3 branched) .. (in part) ..... sticticus

30. (21) Siphon slender, 4.0-5.0 x 1; usually 3 or 4 upper head hair, 2 or 3 lower head hairs; 12-28 comb scales having strong median spine twice as long as lateral spines; last pecten tooth nearly as long as diameter at end (apex) of air tube ..... fitchii
Siphon less than 4 x 1, pecten teeth less than ½ diameter of siphon at apex 31

31. (30) Upper head hairs usually 3 or fewer branches, lower head hairs 1-3 branches; comb scale lateral spines not more than 1/2 as long as median spine 32
Upper head hairs 4 or more branches, lower head hairs with 3 or more branches; comb scale lateral spines at least 2/3 as long as median spine 34

32. (31) Saddle hair longer than saddle; about 40 comb scales; upper head hairs 3-4 branched, lower head hairs usually double (occasionally 3 branched); ventral brush with about 2 precratal tufts ..... schizopinax
Saddle hair shorter than saddle; 18-36 comb scales; upper head hairs 2-4 branched, lower head hairs 1-3 branched 33

33. (32) Ventral brush with 4 or more precratal tufts; 20-36 comb scales; upper head hairs 3-4 branched, lower head hairs double or triple ..... (in part) ..... flavescens
Ventral brush with less than 4 precratal tufts; 18-25 comb scales; upper head hairs 2-4 branched, lower head hairs double (sometimes 1 or 3) ..... (in part) ..... sticticus

34. (31) Siphon stout, less than 3x1 (usually about 2.5x1) many comb scales (about 60-70+); pecten teeth reach near middle of siphon; mesothorasic hair No. 5 single ..... pionips
Siphon longer usually 3x1 or greater; less than 55 comb scales; pecten confined to basal 2/5 of siphon; mesothorasic hair No. 5 single or double 35

35. (34) Comb scales 20-36; mesothorasic hair No. 5 single; prothorasic hair 3 short, less than 1/2 as long as prothorasic hair 1 ..... canadensis
Comb scales 35-55; mesothorasic hair No. 5 double or triple; prothorasic hair 3 medium, more than 1/2 as long as prothorasic hair 1 ..... pullatus

Key to Montana Species of Fourth Stage *Culex* Larvae

1. Lower head hairs single or double ..... territans
Upper and lower head hairs with 3 or more branches 2

2. Antennae nearly uniform in shape, tuft near middle; three pairs of long single hairs and one pair of 2-3 branched hairs on air tube ..... restuans
Antennae constricted beyond antennal tuft; 4 or more pairs of multiple hair tufts on air tube 3

3. Tufts on air tube are in a straight line ..... tarsalis
One or two pairs of tufts on air tube are laterally out of line; upper and lower head hairs of 5 or more branches ..... pipiens

Key to Montana Species of Fourth Stage *Culiseta* Larvae

1. Hair tuft on antennae attached near middle; pecten followed by a row of long single hairs 2
Hair tuft on antennae attacted at distal third; pecten not followed by a row of long single hairs 5

2. (1) Upper and lower head hairs multiple, similar in size and number of branches ..... impatiens

Lower head hairs in 3 or 4, upper head hairs multiple and usually longer 2

3. (2) Lateral hair of anal segment strong, single to triple, as long or longer than anal plate; basal pecten with 3-4 outstanding teeth ..... inornata
Lateral hairs of anal segment fine, shorter than anal plate 3

4. (3) Basal pecten teeth slender with 1 or 2 appressed teeth; mesothorasic hair 1 small, usually single; anal plate narrow, widely separated from barred area of ventral brush; prothorasic hair No. 1 long, 2-4 branched ..... incidens
Mesothorasic hair 1 small, usually multiple; anal plate broad, close to barred area of ventral brush; prothorasic hair No. 1 long, single ..... alaskaensis

5. (1) Upper head hair usually with 7 or more branches; head hair 7 usually with 9 or more branches ..... s. minnesotae
Upper head hair usually with 5 or fewer branches; head hair 7 usually with 8 or less branches ..... m. dyari

Key to Montana Species of Fourth Stage Coquillettidia and Psorophora Larvae

Records indicate that each genus is represented by only one species. Coquillettidia perturbans larvae have long conspicuous tufted antennae and has one margin of the air tube forming a saw. Psorophora signipennis larvae have an inflated air tube, small pecten with four spines at the base and a sclerotized plate completely encircling the anal segment.

Figure 3.

Characters Used in Classification of Adult Female Mosquitoes

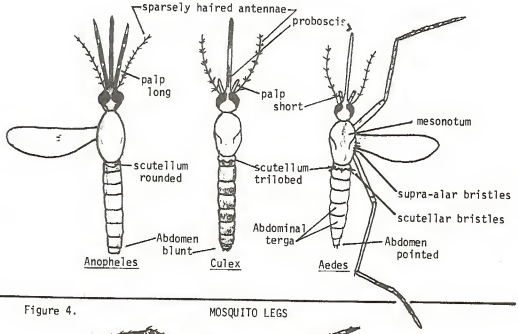


Figure 4. MOSQUITO LEGS

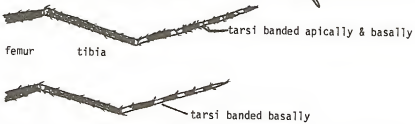


Figure 5. MOSQUITO WING

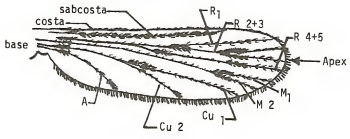


Figure 6.

ADULT CHARACTERS USED IN IDENTIFICATION

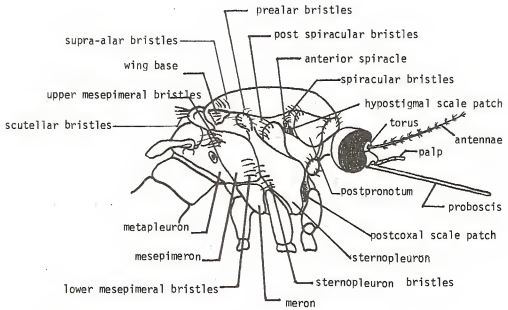
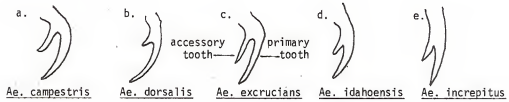


Figure 7.

TARSAL CLAW EXAMPLES: (foreleg claws)



KEY TO ADULT FEMALE MOSQUITOES OF MONTANA

Key to Montana Genera of Adult Female Mosquitoes

1. Palpi about as long as proboscis, scutellum rounded, not lobed ..... Anopheles
   Palpi much shorter than proboscis; scutellum trilobed 2

2. Tip of abdomen pointed, segments 7 and 8 narrowed, 8 retractile; postspiracular bristles present 3
   Tip of abdomen blunt, not narrowed, segment 8 short but not retractile; postspiracular bristles absent 4

3. Spiracular bristles present; first hand tarsal segment with 2 widely separated black bands ..... Psorophora
   Spiracular bristles absent, first hand tarsal segment with one band or none ..... Aedes

4. Wing scales very broad; mixed dark and light colored; proboscis pale banded ..... Coquillettidia
   Wing scales hair-like; proboscis pale banded or not 5

5. Spiracular bristles absent; base of subcostal vein without a tuft of hairs on underside of wing ..... Culex
   Spiracular bristles present; base of subcostal vein with a tuft of hairs on underside of wing ..... Culiseta

Key to Montana Species of Adult Female Anopheles

1. Wings spotted with patches of pale scales (other than apical spot) ..... punctipennis
   Scales on wings dark, wings with 4 dark spots 2

2. Fringe at apex of wing uniformly dark ..... freeborni
   Fringe at apex of wing with a patch of golden or coppery scales ..... earlei

Key to Montana Species of Adult Female Aedes

1. Hind tarsi with pale bands 2
   Hind tarsi without pale bands 15

2. (1) Some tarsal segments banded basally and apically 3
Tarsal segments banded only basally 7

3. (2) Wings with dark and pale scales intermixed; abdomen with dorsal median longitudinal stripe of pale scales 4
Wing scales entirely dark or with few pale scales on anterior veins; no longitudinal stripe of pale scales on abdomen 6

4. (3) Wings with dark and pale scales rather evenly intermixed; primary tooth of tarsal claw abruptly curving near attachment of the relatively long accessory tooth (Fig. 7a)..... campestris
Wings with dark and pale scales not evenly intermixed; vein R 4+5 mostly dark-scaled, primary tooth of tarsal claw curves gradually 5

5. (4) Costal vein mostly dark scaled; accessory tooth of tarsal claw relatively long ..... melanimon
Costal vein mostly pale scaled; accessory tooth of tarsal claw short (Fig. 7b) ..... dorsalis

6. (3) Scutellum with narrow yellowish scales; palpi dark; mesonotum reddish yellow to reddish brown ..... canadensis
Scutellum with broad white scales; palpi with pale bands; mesonotum dark brown with varied pattern of golden yellow and white scales in lines or patches ..... sierrensis

7. (2) Proboscis without pale band 8
Proboscis with pale band ..... (in part) ..... nigromaculis

8. (7) Tarsal bands broad 9
Tarsal bands narrow; pale abdominal bands indented on mid-dorsal line (B-shaped) ..... vexans

9. (8) Abdomen with numerous dark scales and some pale bands 10
Abdomen clothed with numerous yellow scales; wing scales mostly pale, large mosquito ..... flavescens

10. (9) Palpi with some pale scales; pale abdominal scales not forming an obvious mid-dorsal longitudinal stripe 11
Palpi dark-scaled; abdomen with mid-dorsal longitudinal stripe of pale scales ..... (in part) ..... nigromaculis

11. (10) Primary tooth and accessory tooth of tarsal claw on foreleg not parallel 12
Primary tooth and long accessory tooth of tarsal claw on foreleg nearly parallel (Fig. 7c); wing scales mostly dark with some pale scales intermixed; mesonotum reddish brown with few white patches or lines; meron not scaled ..... excrucians

12. (11) Tarsal claw on foreleg not markedly curved, accessory tooth less than 1/2 length of primary tooth (Fig 7e); hypostigmal scale patch present or not 13
Tarsal claw on foreleg markedly curved, accessory tooth 1/2 or more as long as primary tooth; no hypostigmal scale patch 14

13. (12) Proboscis dark-scaled, few or no scattered pale scales in dark areas on abdominal terga; wing scales mostly dark with scattered pale scales confined to costal, subcostal and R 1 veins; upper rear corner of meron usually with scale patch, no hypostigmal scale patch ..... increpitus
Proboscis with many pale scales; many scattered yellowish scales in dark areas of abdominal terga; wing scales mostly dark with intermixed pale scales not confined to anterior veins, few to many hypostigmal scales..... riparius

14. (12) Tarsal claw of foreleg gradually curved; proboscis black scaled with few scattered pale scales; wing scales mostly dark, intermixed pale scales not confined to anterior veins; meron not scaled ..... fitchii
Tarsal claw of foreleg markedly bent beyond base of accessory tooth; proboscis brown scaled, usually with many pale scales; wing scales mostly dark, pale scales may be intermixed on anterior veins ..... mercurator

15. (1) Mesonotum with broad median longitudinal stripe of dark brown scales broadening posteriorly; sides and anterior margin with silver-white scales ..... hendersoni
Mesonotum otherwise marked 16

16. (15) Mesonotum with a pair of broad yellowish-white to brassy yellow stripes separated by a brown stripe of about the same width ..... trivittatus
Mesonotum otherwise marked 17

17. (16) Wing scales bicolored, mixed pale and dark 18
Wing scales dark or with pale scaled patches confined to bases of veins and anterior veins 19

18. (17) Abdomen with mid-dorsal longitudinal stripe of pale scales or almost all pale scaled; upper half of postpronotum brown scaled ..... spencerii
Abdomen without mid-dorsal longitudinal stripe of pale scales or with incomplete stripe; upper half of postpronotum pale scaled ..... idahoensis

19. (17) Mesonotum without obvious contrasting lines or stripes 20
Mesonotum with obvious contrasting line(s) or stripe(s) 23

20. (19) Postcoxal scale patch absent 21
Postcoxal scale patch present 22

21. (20) Abdomen with white lateral spots usually uniting to form a continuous line; fore-coxae with a patch of brown scales; mesonotum covered with reddish brown scales ..... cinereus
Abdomen with alternating dark and pale patches along lateral line; forecoxae with all pale scales; mesonotum with bronze-brown scales, occasionally with faint narrow brown stripes ..... intrudens

22. (20) Thorax with many long brownish black or black setae (hairs) - giving a very hairy appearance ..... impiger
Thorax with normal setae, not having a very hairy appearance; having numerous pale scales along costa, subcosta and vein R_1 ..... cataphylla

23. (19) Postcoxal scale patch absent 24
Postcoxal scale patch present 27

24. (23) Hypostigmal scale patch present; mesonotum with a pair of bare submedian stripes separated by a pair of narrow yellow gold to light brown stripes and a median narrow bare stripe ..... pullatus
Hypostigmal scale patch absent; mesonotum otherwise marked 25

25. (24) Pale scaled abdominal bands narrow and present on less than 1/2 of segments or absent; lower mesepimeral bristles absent ..... dianteus
Pale scaled abdominal bands present on more than 1/2 of segments; lower mesepimeral bristles present or not 26

26. (25) Scutellar and supra-alar bristles dark brown or black; lower mesepimeral bristles present ..... communis
Scutellar and supra-alar bristles yellow or yellowish-brown, lower mesepimeral bristles absent ..... sticticus

27. (23) Scales on sternopleuron extend halfway to anterior angle, narrowly separate from scale patch on prealar area; pale scaled knee spots present; hypostigmal scale patch present or not ..... implicatus
Scales on sternopleuron extend to anterior edge 28

28. (27) Hypostigmal scale patch present; pale scaled knee spots absent ..... provocans
Hypostigmal scale patch absent 29

29. (28) Proboscis with yellow-gray scales on ventral surface ..... schizopinax
Proboscis dark scaled 30

30. (29) Wing usually lacking a patch of white scales at base of costa, up to 6 scales rarely present..... punctor
Wing usually with prominent patch of white scales at base of costa, occasionally all dark 31

31. (30)Supra-alar and scutellar bristles dark brown or black ..... pionips
Supra-alar and scutellar bristles yellowish to yellowish-brown ..... hexodontus

Key to Montana Species of Adult Female Culex

1. Proboscis and tarsi ringed with white..... tarsalis
Proboscis and tarsi without contrasting rings 2

2. (1) Abdominal segments with white scales at apex (most posterior edge), most evident at sides ..... territans
Bases of abdominal segments with white or yellowish scales 3

3. (2) Mesonotum clothed with fine coppery scales and two small white patches near middle; narrow or indistinct abdominal bands not rounded posteriorly and broadly joined to lateral scale patches ..... restuans
Mesonotum clothed with coarse brassy scales, without white patches; rather wide pale abdominal bands rounded posteriorly and narrowly joined or separate from lateral scale patches ..... pipiens

Key to Montana Species of Adult Female Culiseta

1. Hind tarsi with pale scaled rings 2
   Hind tarsi unringed 5

2. (1) Some tarsal segments with broad white rings, ring on second segment covering 1/4 to 1/3 of segment ..... alaskaensis
   Rings on tarsal segments narrow, ring on second segment covering about 1/10 of segment 3

3. (2) Wings with dense patches of dark scales ..... incidens
   Wings uniformly scaled 4

4. (3) Pale brownish bands on base and apex of abdominal segments ..... s. minnesotae
   Pale whitish bands only at base of abdominal segments ..... m. dyari

5. (1) Wings and hind tarsi dark scaled ..... impatiens
   Many pale scales along costal margin of wings; hind tarsi 1 and 2 sprinkled with pale scales but unbanded ..... inornata

Notes on Mosquito Species Reported in Montana

AEDES CAMPESTRIS Dyar and Knab

DISTRIBUTION: This mosquito is commonly found in association with Aedes dorsalis. It looks similar but is larger, more drab, and less common. Aedes campestris is fairly widely distributed in the more arid, prairie regions, never having been collected in the mountains or wooded sections of the state. (Note: Map 1a)

BIONOMICS: Little is known about the life history. This mosquito over-winters in the egg stage and is very resistant to adverse conditions. Larvae appear to prefer alkaline pools which are rich in organic content. They may be found in rain, snow, or irrigation waste water. Adults have a flight range of about 10 miles.

IMPORTANCE: This mosquito is not sufficiently numerous to constitute a pest by itself. However, it is occasionally an important constituent of the pest mosquito population in irrigated areas particularly in spring and early summer. Females are found resting in the grass by day but will bite readily if disturbed either day or night.

AEDES CANADENSIS Theobald

DISTRIBUTION: Aedes canadensis is a forest species found throughout the western portion of the state on both slopes of the Rockies. It is not found in open prairie regions. (Note: Map 1b)

BIONOMICS: This mosquito overwinters in the egg stage. Preferred larval habitats are temporary woodland pools containing fallen leaves. Larvae may also be found in roadside ditches, ground puddles, isolated oxbows of woodland streams, and backwater areas of rivers floored with dead leaves and grass. In deeper pools the larvae favor the shallow margins. Neutral waters appear to afford the best larval conditions although a broad pH range is tolerated. Larvae may appear in snow water pools in early spring and all summer in freshly formed rain pools. Mail (8) believes that the later larvae result from eggs whose hatching has been delayed and that there is one generation per year in Montana. Adult collections of Aedes canadensis have been made from May to the first week in August.

IMPORTANCE: This mosquito is not a severe pest except in restricted localities since it is confined to wooded regions of the state and it tends to stay close to the breeding sites. Aedes canadensis is a persistant, severe biter and may greatly annoy residents and sportsmen in wooded regions.

AEDES CATAPHYLLA Dyar

DISTRIBUTION: This mosquito ranges along the western mountains and has been collected in Gallatin and Meagher Counties, the Bitterroot Valley, and Glacier Park. (Note: Map 1c)

BIONOMICS: This species overwinters in the egg stage. Larvae were collected in early May in Meagher County. Suitable larval habitat may be woodland pools, grassy pools on river banks, and roadside pools which are floored with mud and leaves. Aedes cataphylla merges early in the spring and adults attack readily. Although there is only one generation per year, the adults emerge at different times at different elevations.

IMPORTANCE: This mosquito is too rare to be of any major importance in this state.

AEDES CINEREUS Meigen

DISTRIBUTION: This species has been considered to be primarily a mountain species as it is known to occur in the Gallatin Valley, the Bitterroot Valley, and in Glacier Park. However, this species has also been collected near Chinook, Malta, Deer Lodge, Kalispell and Livingston. (Note: Map 1d)

BIONOMICS: This species overwinters in the egg stage. Adults first emerge from shallow pools at the edge of melting snow in the woods. Later, adults emerge from rain pools. Larval habitat is always located near timber. It may be woodland pools, seepage from rivers, or occasionally roadside ditches. The water may be neutral to slightly alkaline. The flight range of emerging adults is limited. They remain in the woods close to their breeding habitats and rarely come into the open. This species is commonly associated with Aedes increpitus and Aedes spencerii. Adults of Aedes cinereus may be found between the end of May and mid-August. There is one generation per year.

IMPORTANCE: Aedes cinereus is of little importance in Montana. Although it may be a severe biter, it will not always attack, tends to be quite localized, will not enter houses, and does not move far from shaded areas near its breeding places.

AEDES COMMUNIS (DeGeer)

DISTRIBUTION: This species has been reported almost entirely from forest sections of Montana on both sides of the Continental Divide. (Note: Map 2a)

BIONOMICS: Aedes communis overwinters in the egg stage. Larvae are found in the first formed snow pools, in ground depressions, in mountain meadows and forests, and roadside ditches in the mountains. The floor of these pools is usually covered with leaves, moss, and sparse grass. There is only one generation per year. Larvae have been found during early April and as late as July 3 at an altitude of 8,000 feet. Larvae generally are found in neutral waters but have a pH tolerance of from 6.5 to 7.9. The latest adult collection was made on July 21 in a mountain area although a few may persist throughout the summer. Adults remain in wooded areas during daylight hours but may come into the open to attack in the evening. Adults probably do not move great distances.

IMPORTANCE: This is one of the most common mosquitoes at elevations above 5,000 feet. Where it occurs, it may be numerous and a bad biter, especially at dusk.

AEDES DIANTAEUS Howard, Dyar, and Knab

DISTRIBUTION: This species has only been reported from the Glacier Park area. (Note: Map 2b)

BIONOMICS: This mosquito overwinters in the egg stage. Larvae are found mostly in shaded early spring pools at high altitudes and only in dense forests. Dyar (2) has reported finding this species in flood pools in a mountain valley in mid-summer.

IMPORTANCE: This species is too rare to be of any importance in Montana.

AEDES DORSALIS (Meigen)

DISTRIBUTION: This species is widely distributed both on the prairies and in the mountains. (Note: Map 2c)

BIONOMICS: Eggs are laid singly either on shallow water or in damp depressions. They may remain viable for several years if not flooded. This species overwinters in the egg stage. Suitable larval habitat appears to be quite diverse. It thrives best in waters of high alkalinity but has a pH tolerance range from about 7.1 to 9.6. While its preferred habitat appears to be grassy pools exposed to direct sunlight in prairie regions, this is the dominate form in Milk River Valley irrigation ditches. Larvae commonly develop in irrigation and flood waters. They have been found in open temporary grassy pools, semi-permanent pools with cattails, and other aquatic vegetation as well as in shaded woodland pools. Frequently they are associated with Aedes vexans. At room temperature eggs have been known to hatch in 5 days. Larvae mature in hot weather in nature in about 8 days from the time of hatching. It is possible to have a new generation every 17 days. Adults may be found from early April until late November, but are most common from May to September. Aedes dorsalis is a strong flier and has an effective flight range of 10 to 20 miles or more. Adult females are especially active during evenings and on calm cloudy days. They are, however, vicious biters and will attack day or night.

IMPORTANCE: Aedes dorsalis is one of the three most important mosquito pest species in Montana. Because of its brief developmental period and the fact that there can be a new generation each time water fills depressions containing eggs, this mosquito is a most important economic factor in agriculture. Its life cycle is well adapted to the flood system of irrigation as practiced in many parts of the state. Aedes dorsalis avidly attacks man and livestock and is a severe pest.

AEDES EXCRUCIANS (Walker)

DISTRIBUTION: This species is most frequently found in heavily timbered areas on both sides of the Continental Divide. (Note: Map 2d)

BIONOMICS: There is one generation per year. Larvae are found in open swamps surrounded by woods, grassy marshes, open pools in forests with a gravel bottom floored by dead leaves, and in flooded backwater areas.

The water is usually neutral or slightly alkaline. Larval collections have been made in May. It is often associated with Aedes cinereus and Aedes fitchii. Adults are generally found late in the season (having been collected from July - September in recent years). At lower altitudes however, they will emerge earlier. Females will bite at any time if distrubed but are more active in the evening. This mosquito overwinters in the egg stage.

IMPORTANCE: This mosquito is usually not sufficiently numerous to be of major importance in the state.

AEDES FITCHII (Felt and Young)

DISTRIBUTION: This species is most frequently found in timbered mountainous regions and is common throughout western Montana. It has also been found in northern plains areas. (Note: Map 3a)

BIONOMICS: Eggs are laid at the edge of receeding grassy pools or in crevices in beds of previous pools. This species overwinters in the egg stage. Larvae will often be found at the edges of melting snow or deeper woodland pools early in the spring. Larvae have been found near Glasgow early in April associated with Aedes increpitus. Aedes fitchii is rarely found in exposed temporary water. Larvae appear to thrive best in neutral water, having a pH of about 7.1 but can tolerate alkaline water at 8.3. Adults are found from April to the first week in August, but collections in recent years have all been from June to September. There is one generation per year.

IMPORTANCE: Aedes fitchii is not of great economic importance in this state. It can at times be a pest to fishermen and workers in timbered regions. Cattle on summer ranges in the mountains may be plagued by this mosquito.

AEDES FLAVESCENS (Muller)

DISTRIBUTION: This species is distributed throughout the northern prairie area and may be found in a few open situations in the eastern foothills of the Rocky Mountains. It has not been found in wooded mountainous nor in the south-eastern part of the state. Its occurance west of the Continental Divide is questionable. (Note: Map 3b)

BIONOMICS: Overwintering eggs hatch in early snow pools in the spring. Deeper pools and marshes appear to be favored. Larval development is relatively slow, some having been collected the end of June. Larvae have occasionally been found in ditches around irrigated fields at Malta where the adults are, on occasion, numerous. Larvae thrive in alkaline environments and have been found in water with a pH of between 8.0 and 8.3. Adults may be found from the end of April until the end of July. There is one generation per year.

IMPORTANCE: Aedes flavescens is generally not an important mosquito in Montana since it is rarely sufficiently numerous to constitute a pest. However, it comprised about 20% of biting collections made at Lambert during late June and early July. It reportedly attacks cattle more readily than man.

AEDES HENDERSONI (Cockerell)

DISTRIBUTION: A single reliable record of this species was taken at Missoula, Montana in 1917. (Note: Map 3c)

BIONOMICS: This is one of the two tree-hole mosquitoes of Montana. Eggs are laid singly on the sides of containers or tree-holes which are the preferred larval habitat. Winter is passed in the egg state. There may be several generations per year. Larvae develop very slowly taking nearly a month to mature. This species has a flight range of ½ to 1 mile.

IMPORTANCE: Adults are very rare and the species is of no importance in Montana.

AEDES HEXODONTUS (Dyar)

DISTRIBUTION: Aedes hexodontus is a mountain species. (Note: Map 3d)

BIONOMICS: Little is known of the life history in Montana. This species overwinters in the egg stage. Some eggs hatch as soon as snow begins to melt, while in other cases, hatching is delayed. Larvae may be found in pools in open marshy meadows. Although adult females bite principally at dusk or in shaded situations, they will attack in full sunlight.

IMPORTANCE: This species may be an important pest in a few mountain areas but is generally too uncommon.

AEDES IDAHOENSIS (Theobald)

DISTRIBUTION: Aedes idahoensis is fourth in abundance in Montana. It is widely distributed on the prairies and in the mountains. It is usually associated with Aedes vexans and quite often with Aedes dorsalis, Aedes increpitus, and Aedes melanimon. (Note: Map 4a)

BIONOMICS: Winter is passed in the egg stage. There is one generation per year. Like Aedes dorsalis it prefers alkaline habitats. Eggs may be laid 2½ days after feeding. Mail (8) states that the average number of eggs laid by individuals in the laboratory was 53.1. These eggs were not observed to hatch unless subjected to temperatures below 0° centigrade. At constant temperatures, the average length of larval life was 13 days at 22° centigrade, 10 days at 27° centigrade and 5 days at 32° centigrade. Larvae may be found in snow or rain pools, open meadows, roadside ditches, etc. Adults may fly several miles from their larval habitats. While it is most active at dusk, it may also be a vicious biter in shaded or cloudy situations by day.

IMPORTANCE: Aedes idahoensis is one of the most important species in Montana due to its wide distribution and large numbers in mosquito control areas. It may be a great source of annoyance to both man and livestock.

AEDES IMPIGER (Walker)

DISTRIBUTION: This species has only been reported from Glacier Park. Adults were collected there at Swift Current Pass at an elevation of 7,500 feet at the end of July by Mail (8). (Note: Map 4b)

BIONOMICS: Larvae are found in clear pools formed by melting snow at high elevations in mountains where alpine, arctic conditions exist. The rate of larval development is very slow. This species overwinters in the egg stage. Females are reported to feed readily at all hours even in full sunlight.

IMPORTANCE: This species is too uncommon and occurs at too high altitude to be of economic importance in Montana.

AEDES IMPLICATUS (Vockeroth)

DISTRIBUTION: This species is predominently a forest species. (Note: Map 4c)

BIONOMICS: Larvae are found in temporary pools and are among the first to appear in the spring. Mail (8) reported finding larvae in snow water pools in woods and meadows wooded sections. He reports that larvae have been collected as early as April 4 and as late as July 21. Females bite avidly in the shade by day or the evening. There is only one generation per year.

IMPORTANCE: This mosquito is not numerous enough to be of much importance in the state.

AEDES INCREPITUS (Dyar)

DISTRIBUTION: Aedes increpitus has been found in both mountainous and the prairie regions of the state, however, it is more numerous in the forested mountainous region. Its distribution parallels that of Aedes fitchii. (Note: Map 4d)

BIONOMICS: Aedes increpitus is frequently found in roadside ditches filled with irrigation water or heavy spring rains. It is often found in temporary pools along river banks which are left after high water. Earliest larvae have been obtained from roadside pools early in April. The pH range of water in which larvae have been taken ranges from 7 to 8. Numerous larval collections have been made in early May. Adults may be found from the last week in April until the first week in August. Eggs are laid on damp ground at the edge of pools. More than one generation per year has not been demonstrated.

IMPORTANCE: This mosquito is one of the dominant species in Montana and may invade urban areas, but is of greatest importance in wooded areas. Mail (8) states it is a severe biter and a source of great annoyance to cattle on summer range in the mountains as well as to tourists, sportsmen, and those working in timbered regions during the mosquito season.

AEDES INTRUDENS (Dyar)

DISTRIBUTION: Aedes intrudens is found in the foothills of both slopes of the Continental Divide. It is typically a forest mosquito that does not occur in prairie regions. It is fairly common in timbered country. (Note: Map 5a)

BIONOMICS: Aedes intrudens overwinters in the egg stage. Larvae hatch in snow water which is usually neutral or slightly acidic. However, they have been taken from highly alkaline pools. The larval habitat, which may include woodland pools, marshes, and water filled ditching, is typically floored with dead leaves or moss. There is one generation per year. Adults may be found early in the spring at lower elevations and may be taken late in August at higher elevations.

IMPORTANCE: State wide, this mosquito is not important. However, in certain local areas it may be a vicious pest, both by day and night.

AEDES MELANIMON (Dyar)

DISTRIBUTION: This species is widely distributed in the state. (Note: Map 5b)

BIONOMICS: Very little is known of the life history of this species in Montana. This species overwinters in the egg stage. Eggs hatch in melting snow and woodland pools. Larvae may be found along the edge of small clear mountain streams, in temporary rain pools, but are most commonly found in overflow pools along streams, and in irrigation seepage in the shaded or partly shaded situations. Females will bite during daylight hours in shaded situations but are more active at dusk. Adults may be found between late April and September.

IMPORTANCE: At times, this mosquito may be important in Montana as an economic pest of livestock. Studies in Colorado (5) indicated that 92% of this species collected were engorged with cattle blood. It is among the three most abundant species in some mosquito control areas.

AEDES MERCURATOR (Dyar)

DISTRIBUTION: This species has only been reported from Lolo Hot Springs. (Note: Map 5c)

BIONOMICS: Matheson (9) states that this species breeds in woodland pools, flood pools of rivers, swamps, or marshes. This species overwinters in the egg state. Eggs hatch in melting snow and woodland pools. Adults may be found between late April and August. They feed readily in the woods at all hours.

IMPORTANCE: This is rare and is not important in Montana.

AEDES NIGROMACULIS (Ludlow)

DISTRIBUTION: This species is commonly found in the more arid prairie regions of Montana. It may be one of the chief components of the mosquito fauna in irrigated areas. (Note: Map 5d)

BIONOMICS: This species overwinters in the egg stage but eggs do not appear to require a cold stimulus for hatching. Aedes nigromaculis is able to produce a new brood with each flooding or irrigation, resulting in many generations and large populations each year. Larvae appear to prefer alkaline conditions and are frequently found in open sunlit pools of waste irrigation and other temporary water. Larvae have been found in the middle of May. Adults have typically been collected from late April through the end of August, although one collection was recorded at Cascade in mid-November, 1929. They have an effective flight range of 2 to 5 miles

IMPORTANCE: Aedes nigromaculis is very important within its range and is a severe pest in irrigation districts. In districts affected, it probably ranks third or fourth in number. It ranks fifth in abundance among the mosquitoes of the state. It is a severe pest, readily attacks man and animals and inflicts painful bites.

AEDES PIONIPS (Dyar)

DISTRIBUTION: This species has been collected from high elevations in Glacier Park and in Gallatin County and is strictly confined to forested mountain areas. (Note: Map 6a)

BIONOMICS: This species overwinters in the egg stage. There is one generation per year. Larvae appear in the more permanent pools in dense timber and are slow in developing. Earliest adult records are from the last week in June.

IMPORTANCE: This mosquito is apparently reluctant to feed on man and is too rare to be of any importance.

AEDES PROVOCANS (Walker)

DISTRIBUTION: The only record of distribution was from Glacier Park. (Note: Map 6b)

BIONOMICS: Winter is passed in the egg stage. Larvae are found in pools resulting from melting snow and at the edges of forests. Little is known of the habits of the adults. They have been captured during the months of May and July at Glacier Park.

IMPORTANCE: This mosquito is not a problem in Montana.

AEDES PULLATUS (Coquillett)

DISTRIBUTION: This mosquito has been found only in timber at high elevations and never away from forests. It has been reported to occur in the Little Belt Mountains, Gallatin Canyon, and Yellowstone National Park. (Note: Map 6c)

BIONOMICS: This species is single brooded. Larvae hatch in snow water and ground depressions in the forest and in mountain meadows. At higher elevations, larvae may persist until late summer. Larvae have been collected in May at an elevation of 7,000 feet and in July at 9,000 feet.

IMPORTANCE: Since Aedes pullatus are generally uncommon and occur in restricted localities, it is not of great importance. Although it attacks avidly and can be annoying, its bite is not severe.

AEDES PUNCTOR (Kirby)

DISTRIBUTION: In Montana this mosquito is found on both slopes of the Continental Divide and in mountain valleys, the Bridger Range, and in the Little Belt Mountains. It has never been found on the prairies. (Note: Map 6d)

BIONOMICS: There is one generation per year, overwintering in the egg stage. Aedes punctor larvae may be found in woodland pools with mossy bottoms most often formed from melting snow. Larval habitats are typically slightly acid. The average pH in waters in which they have been found tested from 6.5 to 7.0. Larvae are very resistant to cold, having been found in Alaska in a pool with a thin sheet of ice above and permafrost below. Adults are abundant from the end of May throughout early July in some timbered regions.

IMPORTANCE: This mosquito may be quite a pest in some regions. It is a persistant and severe biter, readily attacking men and animals. At times it is a problem to summer home communities as well as to stock on summer range.

AEDES RIPARIUS (Dyar and Knab)

DISTRIBUTION: Dyar (3) made the only collection on record at Dillon. (Note: Map 7a)

BIONOMICS: No observations have been made on its life history in Montana. Dyar states the larvae expecially occur in early shallow spring pools on the prairie but may also be found in large pools under shrubbery. This species occurs where the forest and prairie meet but extends somewhat into each area.

IMPORTANCE: This species is very rare and of no importance in this state.

AEDES SCHIZOPINAX (Dyar)

DISTRIBUTION: This species has been collected from Gallatin, Jefferson, and Lewis & Clark Counties as well as Mammoth Hot Springs in Yellowstone National Park. (Note: May 7b)

BIONOMICS: This species has one generation per year, overwintering in the egg stage. Larvae have been recovered from small depressions in cattle tracks, around the edge of permanent pools, and open meadows; never in a permanent pool itself. Aedes schizopinax larvae are bottom feeders and rarely come to the surface. Their larval habitat is often highly alkaline (pH 8.0), quite fowl and covered with green scum. Larvae are found between April and May. Little is known of adult habits.

IMPORTANCE: This mosquito is fairly rare and of little importance in Montana.

AEDES SIERRENSIS (Ludlow)

DISTRIBUTION: This species is found in drainages west of the Continental Divide. (Note: Map 7c)

BIONOMICS: Larvae are found in tree-holes or similar areas and may be associated with Aedes hendersoni. All eggs do not hatch at the first flooding. Time of larval development reportedly varies from two weeks to several months, with cold temperature retarding pupation. Little is known of this species in Montana.

IMPORTANCE: Although this species is reported to be an avid biter of man in some parts of the United States and has transmitted Western Equine Encephalitis under laboratory conditions, it is not an important mosquito in Montana because of its rarity.

AEDES SPENCERII (Theobald)

DISTRIBUTION: Aedes spencerii has previously been reported to be a common mosquito from the Yellowstone Trail at Bozeman east to North Dakota and in the northern prairie areas. It may be associated with Aedes dorsalis, Aedes vexans, and Aedes idahoensis in irrigated meadows. (Note: Map 7d)

BIONOMICS: This species overwinters in the egg stage and has one generation per year. Larvae have been found in early May and adults taken in mid-August. Roadside ditches are favored larval habitats. It appears to thrive best in alkaline water. The earliest broods, which develop in pools formed from melting snow, are not injured by nightly freezing over on the pools. Low areas bordering rivers which are filled with seepage and high water can produce large numbers of Aedes spencerii. This species sometimes migrates into cities and towns, though its flight range has not been determined.

IMPORTANCE: This mosquito has a high blood lust. When numerous it severely plagues rural communities, attacking even in bright sunlight. It may also be a severe pest of livestock when present in large numbers.

AEDES STICTICUS (Meigen)

DISTRIBUTION: Although Mail (8) states that all his records were from southern and western portions of the state, the species has been collected from Glacier, Flathead, and Lewis & Clark Counties as well as along the Yellowstone River in recent years. (Note: Map 8a)

BIONOMICS: Eggs are preferentially laid in ground depressions in cottonwood bottom lands which will receive overflow in the spring. If flooding does not occur, they will survive two or three years. Larvae are also found in backwater areas having little current. Pools in loam soil with either live or dead vegetation or both are preferred. Larvae rarely, if ever, are found in highly alkaline or mineral waters. Larval development takes from 10 days to 3 weeks depending on the temperature. Collections in Montana date from early May to August. There is usually only one brood annually. Adults may be locally numerous following floods. The adults may live 3 months and range up to 25 or 30 miles.

IMPORTANCE: This small to medium mosquito is numerous enough to be a great pest in restricted areas of Montana. It readily enters houses and appears to have a strong blood lust, feeding on man, livestock, and rabbits in cloudy or shaded situations as well as in the evening.

AEDES TRIVITTATUS (Coquillett)

DISTRIBUTION: This species is found in the prairie regions of northern and southern Montana, expecially along river bottoms. (Note: Map 8b)

BIONOMICS: Larvae are generally found in flood pools of river bottoms and in rain filled pools in the woods. It may also be found in open semi-permanent pools in association with Aedes vexans. The larval habitat is typically quite alkaline. Larvae have been found in water with a pH from about 8.5 to 9.0. Later larval instar spend the majority of their time concealed in vegetation at the floor of the pool. The duration of larval development is about 8 days. Adults rest among grasses and in shrubbery by day. It is mostly found in lightly wooded or open areas. They are fierce biters when disturbed or in the evening, however they do not migrate far from their breeding sites. This species overwinters in the egg stage. Howard et al. (7) believes there may be several generations per year in Montana. They are common from June through August.

IMPORTANCE: This mosquito may be numerous and important in local areas near breeding places.

AEDES VEXANS (Meigen)
(The Flood-Water Mosquito)

DISTRIBUTION: This species is widely distributed in the state both in open forest meadows in the mountains and on the prairies. It is generally associated with Aedes dorsalis and is about as numerous. (Note: Map 8c)

BIONOMICS: Eggs are laid singly on the ground, hatching when flooding occurs. The U. S. Department of Health, Education, and Welfare publication entitled "Mosquitoes of Public Health Importance and Their Control" states that over most of their range, Aedes vexans produce several broods each year but that in some western states where flooding occurs only in the spring they are single-brooded. In contrast, Mail (8) noted that a stimulus of sub-zero temperatures appeared to be necessary to stimulate hatching. He also stated that the rate of development of eggs of Aedes vexans was very uneven, hatching occurring at irregular intervals. Hearle (6) observed that not all eggs hatch with a single flooding but that larvae appear periodically after alternate flooding and drying of the eggs during the course of the summer. Development of aquatic stages generally requires 10 days to 3 weeks depending on temperatures. Eggs of Aedes vexans as well as eggs of Aedes dorsalis are very resistant to unfavorable environmental conditions. They have been observed to resist drying for up to 20 months in a refrigerator. Aedes vexans breeds in rain pools, flood waters, roadside puddles, and practically all bodies of fresh water. In Montana it is one of the dominant forms in irrigated

areas. The preferred larval habitat is open sunlit pools such as in roadside ditches and flooded meadows under irrigation. This species is rarely found in shaded situations. Adults are strong fliers and commonly migrate 5 to 10 miles from their breeding sites. They are frequently collected in light traps from May through September.

IMPORTANCE: Aedes vexans ranks among the three most important pest mosquitoes in Montana. It occurs in enormous numbers, is very aggressive, and is a vicious biter.

ANOPHELES EARLEI (Vargas)

DISTRIBUTION: This species has been found east of the Continental Divide. (Note: Map 9a)

BIONOMICS: Little is known of its biology in Montana. Larvae may be collected in the grassy margins of small sluggish streams, and in shallow margins of semi-permanent and permanent ponds overgrown with emergent and floating vegetation. They are occasionally taken in woodland pools and marshes. Females are most active at dusk, will readily enter buildings, and attack man. The females overwinter in "hibernation". Following hibernation, females will attack even in bright sunlight.

IMPORTANCE: This species is important only in local areas in Montana.

ANOPHELES FREEBORNI (Aitken)
(The Western Malaria Mosquito)

DISTRIBUTION: This species is well scattered throughout the state, having been reported from Blaine County in the north to Powder River County in the southeast, and in the west on both sides of the Continental Divide. (Note: 9b)

BIONOMICS: Eggs are laid singly on the water. There may be many broods each year. The preferred larval habitat is clear, clean, slightly alkaline, semi-permanent or permanent water which is partly shaded, partly sunlit, and which contains some vegetation or floating vegetation. Water polluted with sewage or other organic matter is usually avoided as is water in artifical containers. Anopheles freeborni has adapted to seepage areas, borrow pits, hoof prints, irrigation canals, and improperly irrigated fields. The adult female readily enters houses and animal shelters and bites avidly at dusk and dawn. This mosquito commonly rests during the day in cool shaded areas such as in the corners of buildings, under bridges, and in culverts. This species has an effective mid-summer flight range of 1 to 2 miles. Males usually remain within 1/4 of a mile of their breeding places. In the fall, females may migrate 10 to 12 miles and overwinter in sheltered out buildings, houses, cellers, etc.

IMPORTANCE: Although this mosquito is the carrier of malaria in the western states, it is of no importance as such in Montana. There are not sufficient numbers to constitute a serious pest problem in Montana.

ANOPHELES PUNCTIPENNIS (Say)

DISTRIBUTION: This species has been reported from Lolo and the Bitterroot Valley on the Pacific side of the Continental Divide. (Note: Map 9c)

BIONOMICS: This species breeds chiefly in semi-permanent or permanent fresh water pools containing vegetation or floating debris. Larvae may be found in a variety of habitats including shallow waters of grassy bogs, swamps, sloughs, borrow pits, spring pools, artificial containers, and margins of streams, preferring cool water and shaded woodland pools. There are several generations per year. Mated adult females overwinter in hibernation.

IMPORTANCE: This mosquito is reported to be a rather vicious biter out-of-doors but apparently it does not readily enter homes. The rarity of this species in Montana makes it very unimportant.

CULEX PIPIENS (Linnaeus)
(The Northern House Mosquito)

DISTRIBUTION: (Note: Map 10a).

BIONOMICS: Culex pipiens larvae may be found in permanent or semi-permanent water with high organic matter or pollution. Eggs are laid as rafts of from 50 to 400 eggs on water. In warm weather, hatching occurs within 2 days. Larvae and pupae can complete development in 10 days. In cool weather, 2 or more weeks may be required. There may be several broods each year. Overwintering is as the adult female. This species may be found near urban communities and rural buildings where it readily enters houses. Culex pipiens may fly one mile or more, however like most domesticated mosquitoes, it will often fly only a few hundred yards. Generally, larvae may be found in the vicinity of the adults. Adults are active at night and rest by day around buildings and various sheltered areas. They are readily collected by light traps. Colorado studies may indicate that birds are the preferred host (5) although they do feed on man.

IMPORTANCE: This species is not too common in Montana. Although not a confirmed vector in Montana, western equine and St. Louis encephalitis viruses have been isolated from wild caught specimens in Washington. It is also known to transmit the virus of fowl pox.

CULEX RESTUANS (Theobald)

DISTRIBUTION: (Note: Map 10b).

BIONOMICS: Culex restuans usually breeds in semi-permanent or permanent fowl water containing decaying grass or leaves. Preferred larval habitat includes woodland pools, ditches, rainbarrels, tin cans, etc. Adults appear early in the spring and breed throughout the summer.

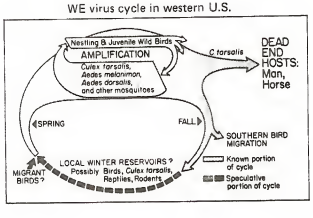
IMPORTANCE: Culex restuans is relatively unimportant in Montana.

CULEX TARSALIS (Coquillett)

DISTRIBUTION: Culex tarsalis has been found in many localities throughout both the prairies and in the mountains. This species is very common in Montana. (Note: Map 10c)

BIONOMICS: Culex tarsalis has several generations per year. Almost any collection of temporary or semi-permanent water (usually waste water) is suitable larval habitat . Larvae are frequently found in water associated with irrigation, in for example, canals, ditches, borrow pits, impoundments, ground pools, and hoof prints. Culex tarsalis often breeds in water of high organic content such as effluent from cesspools, dairy barns or corrals, and has a wide range of tolerance to different ions. Eggs are laid as rafts on water, each female generally depositing two rafts. Egg rafts may contain from 50 to 150 eggs. Eggs usually hatch within 2 days. Larvae and pupae develop rather rapidly. According to Hagstrom and Workman (4), at a high feeding rate and a temperature of 20° C., the average duration of larval stages 1 to 4 were 3.6, 2.2, 3.2, 5.6, and 2.0 days respectively. At the highest feeding rate and a temperature of 30° C., the duration of the larval stages were 2.9, 1.8, 2.1, and 4.9 days respectively. There may be many broods each year. Although most Culex tarsalis will remain within a mile of their breeding sites, this species has an effective flight range of between 2 and 10 miles. They usually feed from dusk to dawn and rest in secluded spots by day. Usual resting areas are in grasses and shrubs but they are frequently found on shaded sides of buildings, porches, under bridges, and so forth. This species is readily taken in light traps and dry ice (carbon dioxide) traps. Adults have been collected in Montana from late May to early September. This mosquito overwinters as the engorged mated female. A blood meal is apparently needed in order to produce fertile eggs.

IMPORTANCE: Culex tarsalis is the most important vector of Western equine encephalitis virus to man and horses in Montana. To date the greatest number of such cases on record occurred in 1965 with 333 cases reported in horses and 12 in man. St. Louis encephalitis, which occurs sporadically in Montana, is also spread by Culex tarsalis. Birds, which act as a reservoir of these diseases, appear to be the preferred host of this species. However, it readily attacks cattle, horses, and man.



CULEX TERRITANS (Walker)

DISTRIBUTION: This species has been reported from Blaine County, Glacier Park, Laurel and probably occurs over a large portion of the state. (Note: Map 10d)

BIONOMICS: Rather cool, deep-shaded water, with aquatic vegetation is the preferred larval habitat. However larvae may be found in a variety of situations, having been found in grassy pools, the edges of ponds where suitable shade exists, and in marshes. Eggs are laid on the water surface in the spring. There is generally only one generation per year. It overwinters as the mated female. Culex territans apparently does not bite man but feeds chiefly on frogs and snakes.

IMPORTANCE: This mosquito is rare and since it does not attack warmblooded animals, it is of no known importance in Montana.

CULISETA ALASKAENSIS (Ludlow)

DISTRIBUTION: This species has been reported from the Gallatin Valley and from Cascade, Lewis & Clark, and Meagher Counties. (Note: Map 11a)

BIONOMICS: The eggs of this species are laid in rafts on the surface of the water. Larvae are reported to generally be found in grassy marshes in river valleys. Mail (8) reports collecting larvae from a pool formed by melting snow near woods along the Gallatin River. There is one generation per year. Adults have been collected in May with several larval collections having been made the middle of June.

IMPORTANCE: Culiseta alaskaensis is not important as it is fairly rare in Montana.

CULISETA IMPATIENS (Walker)

DISTRIBUTION: This species is found throughout the mountainous region along both sides of the Continental Divide. (Note: Map 11b)

BIONOMICS: This mosquito hibernates during the winter as the mated female. Eggs are laid in the spring in rafts on water surfaces of deep well shaded woodland pools and, rarely, in the open. Mail (8) located these larvae in water of a pH of from 6.8 to 7.0. This species is believed to have one generation per year. Adults are normally timid and are severe biters only for a few days immediately after emerging from hibernation. This species may be numerous in April and May but is usually comparatively scarce by June. Early July collection have been made.

IMPORTANCE: This mosquito is of little importance in Montana as it is very rare and not found in heavily populated areas.

CULISETA INCIDENS (Thomson)

DISTRIBUTION: Culiseta incidens is found on both sides of the main range of the Rocky Mountains. (Note: Map 11c)

BIONOMICS: This species breeds in a wide variety of aquatic habitats from brackish water pools to pools formed from melting snow. Larvae may be located in reservoirs, hoof prints, polluted pools, and artificial containers. Eggs are laid in long, narrow rafts preferentially on clear or semi-clear permanent pools with partial shade. This mosquito overwinters as the hibernating adult female.

IMPORTANCE: This species will attack cattle readily and when numerous, may be an important livestock pest.

CULISETA INORNATA (Williston)

DISTRIBUTION: Culiseta inornata occurs throughout the state. This is commonly found in both open prairies and in the mountains. (Note: Map 11d)

BIONOMICS: This mosquito overwinters as a hibernating adult female in sheltered places. The hibernating female comes out during warm winter days and early in the spring. Breeding occurs throughout the spring and summer. Eggs are laid in boat shaped masses on the water surface. Larvae are frequently found in very cold water. Permanent pools are preferred breeding places although semi-permanent water may also be used. The first generations develop somewhat slowly in the spring due to the low temperatures of most pools, but later in the summer development is much more rapid. Earliest larval collections have been made in Montana on June 3 at an elevation of 7,000 feet. Larvae are common by mid-June. They can live under a wide variety of conditions having been taken not only from very cold water but, as Mail (8) reports, from warm sulphur water where each instar was coated with a deposit of sulphur. Adults have been commonly collected from June to September. They are often associated with but seem to slightly preceed Culex tarsalis.

IMPORTANCE: Culiseta inornata does not have a strong blood lust for man but can be troublesome if numerous. It can annoy cattle and sheep and be an economic pest. Although this species has been found to be naturally infected with western equine encephalitis virus, its feeding makes it unlikely to be an important vector to man.

CULISETA MORSITANS DYARI (Coquillett)

DISTRIBUTION: No local records exist. Occurrence reported by Nielson et al. [12]

BIONOMICS: Little is known of its biology in Montana. Egg rafts are reportedly laid on moist surfaces above water lines around marshes, bogs, and pockets formed by treefalls. Larval development is reported to be slow. Although the overwintering mechanism is uncertain, it is suspected that overwintering occurs in the larval stage. There is probably one generation per year.

IMPORTANCE: This species is rare, rarely feeds on man and is unimportant in Montana.

CULISETA SILVESTRIS MINNESOTAE (Barr)

DISTRIBUTION: No local records exist. Occurrence reported by Nielsen et al.[12]

BIONOMICS: Little is known of its biology in Montana, but larvae would be found in semi-permanent marshes. Overwintering is thought to be by adult females. Biting habits are not known.

IMPORTANCE: This species is rare and of no known importance in Montana.

COQUILLETTIDIA PERTURBANS (Walker)

DISTRIBUTION: This species has been collected at Bigfork. Little else is known of its distribution in Montana. (Note: Map 9d).

BIONOMICS: This species lays eggs in rafts on marshes, ponds, and lakes with thick, aquatic vegetation. Larvae may be found in association with cattail and water sedges. Larvae remain below the surface breathing through tubes which are adapted for penetrating the plants from which they get their air. Larvae develop slowly. Coquillettidia perturbans overwinters as larvae attached to roots of plants. There is only one generation per year. Following a 5 or 6 day pupal period, adults emerge in the spring. They have an effective flight range of 1 to 5 miles or more. Females readily enter houses and bite viciously. They are principally active at dusk and the early part of the evening.

IMPORTANCE: Coquillettidia perturbans is too rare in Montana to be of any importance.

PSOROPHORA SIGNIPENNIS (Coquillett)

DISTRIBUTION: This species is found in arid river valley areas of northern and southern Montana prairies. (Note: Map 8d).

BIONOMICS: Little is known of the life history of this mosquito. Presumably, it passes the winter in the egg state. This species is well adapted to breeding in temporary pools. Larvae have been found in roadside and rain pools. Under favorable conditions, it may develop from egg to adult in 5 days. There may be several generations each year. The adult female bites readily and inflicts a painful bite.

IMPORTANCE: This species is too rare to be of major importance in Montana.

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4. Hagstrum, D. W. and E. B. Workman (1971) Interaction of temperature and feeding rate in determining the rate of development of larval Culex tarsalis (Diptera, Culicidae) Ann. Entomol. Soc. Amer. 64:668-671.

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6. Hearle, E. (1926) The Mosquitoes of the Lower Fraser Valley, British Columbia and Their Control, National Research Council Report 17:1-94. (as quoted by Carpenter and LaCasse).

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10. Pratt, H. D. and K. S. Littig (1971) Mosquitoes of Public Health Importance and Their Control, revised, U.S. Department of Health, Education, and Welfare, Public Health Service, 94 pp.

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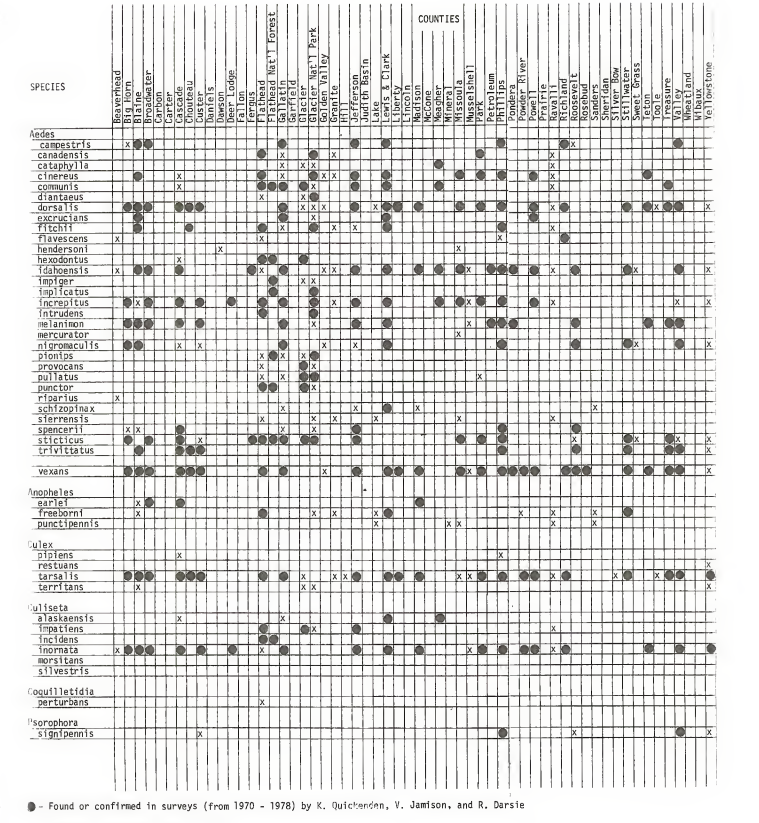
12. Nielsen et al. (1963) Proceeding 50th mtg. N.J. Mosq. Exterm. Assoc. pp. 424-428.

Appendix I

Summary of Mosquito Distribution



● - Found or confirmed in surveys (from 1970 - 1978) by K. Quickenden, V. Jamison, and R. Darsie

x - Reported in surveys prior to 1970

Appendix II

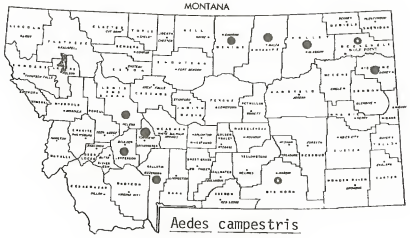
Distribution Maps

Symbols on the species distribution maps represent collection(s) of a species within the county where the symbol appears. They do not identify a specific collection site nor do they imply that a species is distributed throughout a county. The distribution of a specific mosquito may, in fact, be restricted to unique environments or microhabitats.

The absence of collection records within a county does not necessarily indicate that a mosquito does not occur there. Lack of records may reflect sampling biases. Surveys may not have been conducted at the appropriate times or places to collect some species of mosquitoes and sampling intensity has varied across the state.

Appendix II: Distribution Map 1

a.

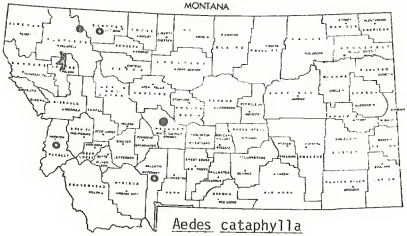


Aedes campestris

b.

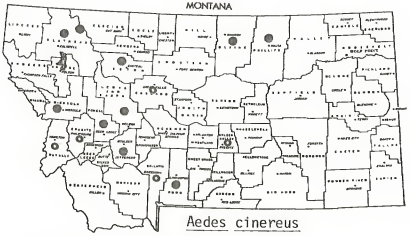
Aedes canadensis

c.



Aedes cataphylla

d.

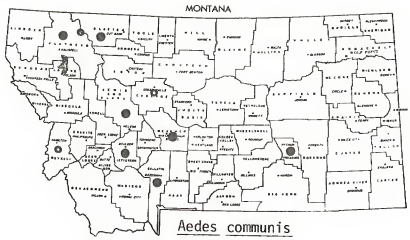


Aedes cinereus

o - Reported in surveys prior to 1970.
● - Found or confirmed in surveys from 1970 - 1978.

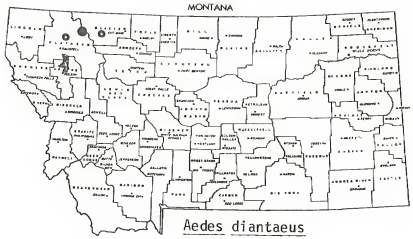
Appendix II: Distribution Map 2

a.



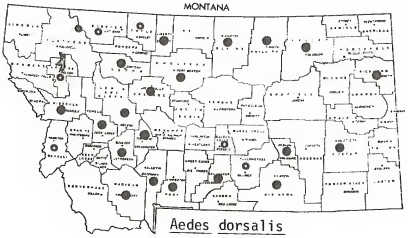
Aedes communis

b.



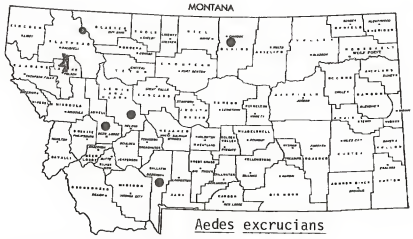
Aedes diantaeus

c.



Aedes dorsalis

d.

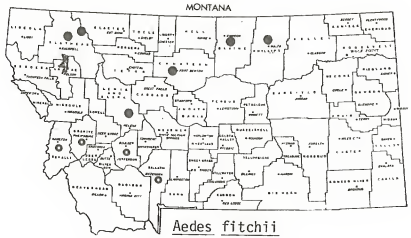


Aedes excrucians

o - Reported in surveys prior to 1970.
● - Found or confirmed in surveys from 1970 - 1978.

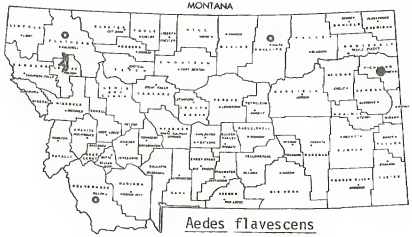
Appendix II: Distribution Map 3

a.



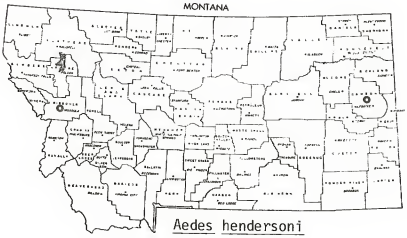
Aedes fitchii

b.



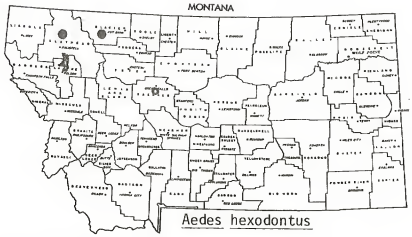
Aedes flavescens

c.



Aedes hendersoni

d.

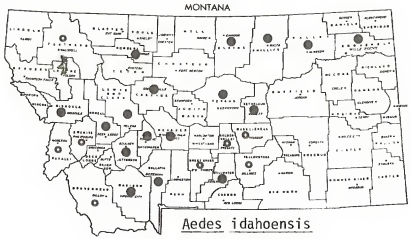


Aedes hexodontus

o - Reported in surveys prior to 1970.
● - Found or confirmed in surveys from 1970 - 1978.

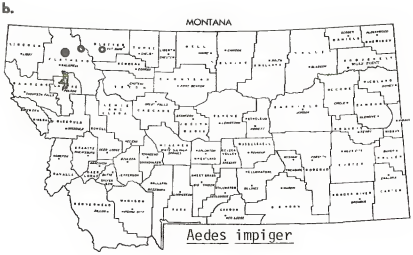
Appendix II: Distribution Map 4

a.



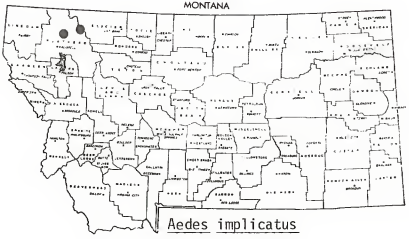
Aedes idahoensis

b.



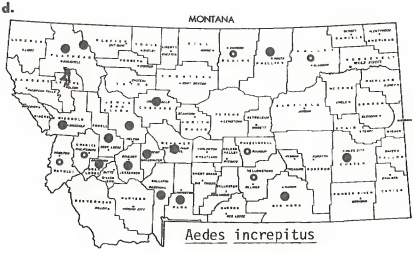
Aedes impiger

c.



Aedes implicatus

d.

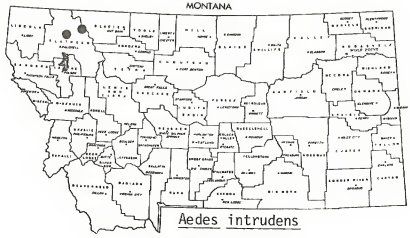


Aedes increpitus

o - Reported in surveys prior to 1970.
● - Found or confirmed in surveys from 1970 - 1978.

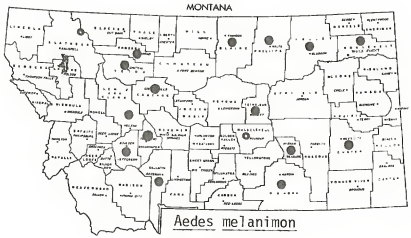
Appendix II: Distribution Map 5

a.



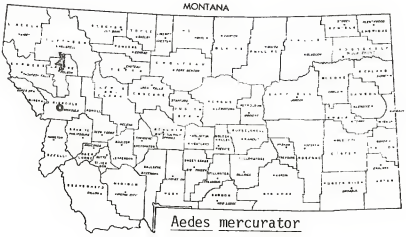
Aedes intrudens

b.



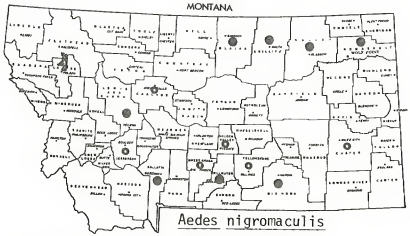
Aedes melanimon

c.



Aedes mercurator

d.

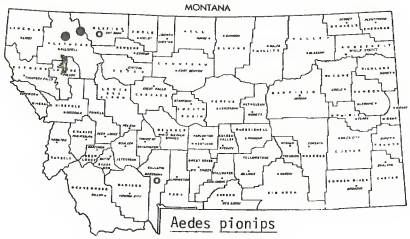


Aedes nigromaculis

o - Reported in surveys prior to 1970.
● - Found or confirmed in surveys from 1970 - 1978.

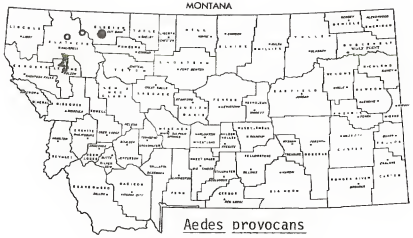
Appendix II: Distribution Map 6

a.



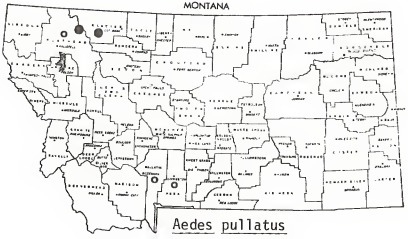
Aedes pionips

b.



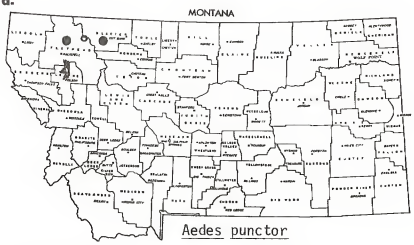
Aedes provocans

c.



Aedes pullatus

d.

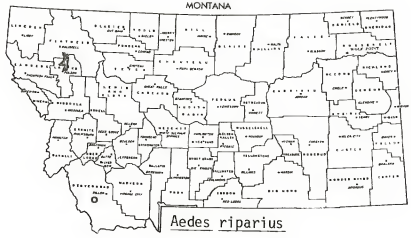


Aedes punctor

o - Reported in surveys prior to 1970.
● - Found or confirmed in surveys from 1970 - 1978.

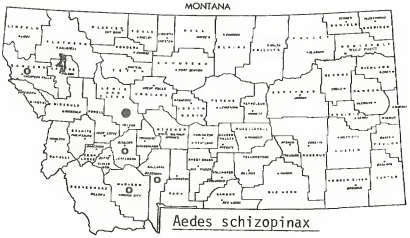
Appendix II: Distribution Map 7

a.



Aedes riparius

b.



Aedes schizopinax

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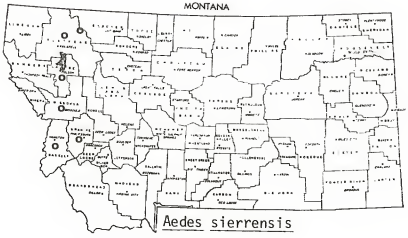
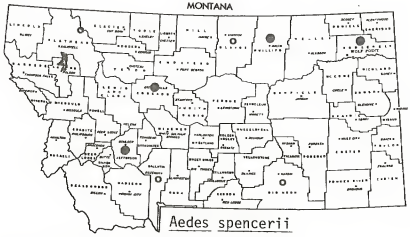


Aedes sierrensis

d.

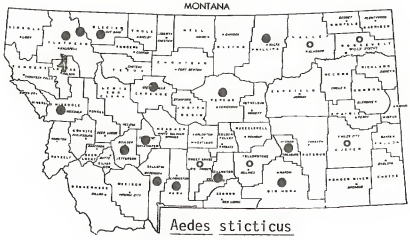


Aedes spencerii

o - Reported in surveys prior to 1970.
● - Found or confirmed in surveys from 1970 - 1978.

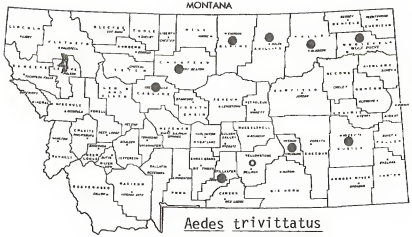
Appendix II: Distribution Map 8

a.



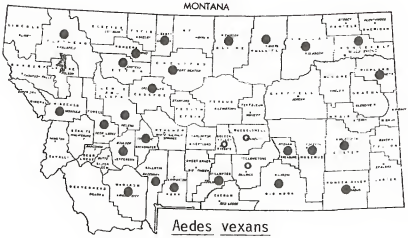
Aedes sticticus

b.



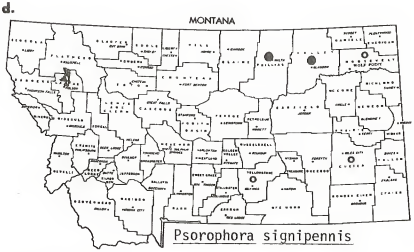
Aedes trivittatus

c.



Aedes vexans

d.

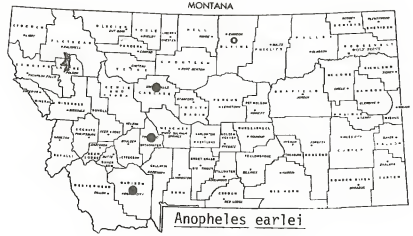


Psorophora signipennis

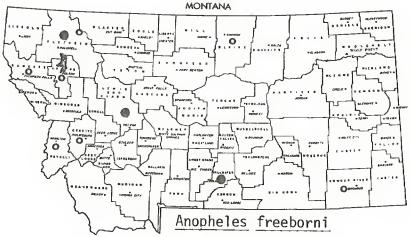
o - Reported in surveys prior to 1970.
● - Found or confirmed in surveys from 1970 - 1978.

Appendix II: Distribution Map 9

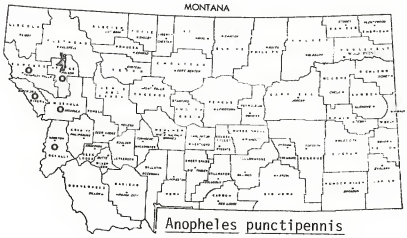
a.



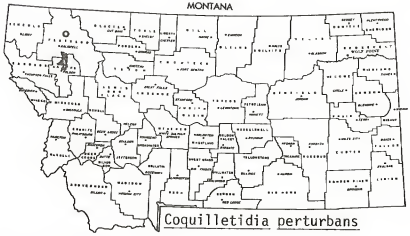
b.



c.



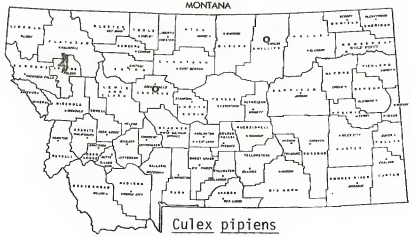
d.



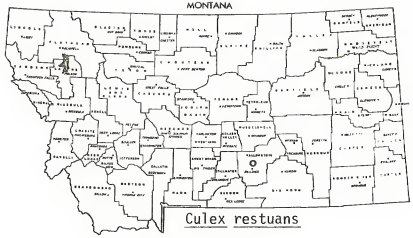
o - Reported in surveys prior to 1970.
● - Found or confirmed in surveys from 1970 - 1978.

Appendix II: Distribution Map 10

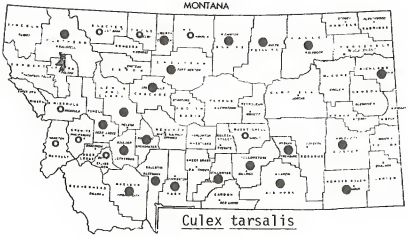
a.



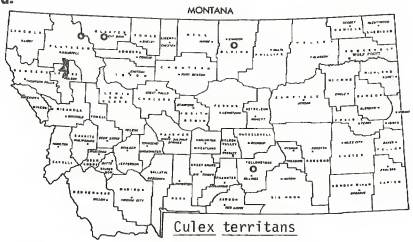
b.



c.



d.



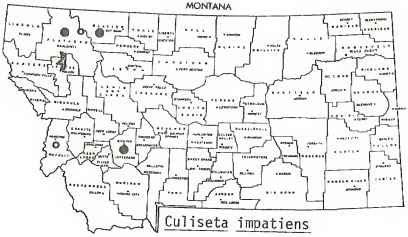
o - Reported in surveys prior to 1970.
● - Found or confirmed in surveys from 1970 - 1978.

Appendix II: Distribution Map 11

a.

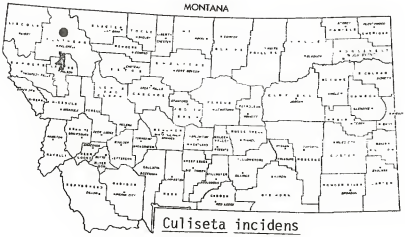
Culiseta alaskaensis

b.



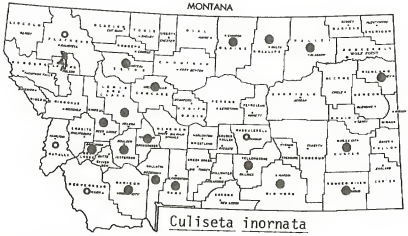
Culiseta impatiens

c.



Culiseta incidens

d.



Culiseta inornata

o - Reported in surveys prior to 1970.
● - Found or confirmed in surveys from 1970 - 1978.

Appendix III

SUMMARY OF A DETAILED SURVEY IN IRRIGATED AREAS OF THE MILK RIVER VALLEY NEAR CHINOOK AND HARLEM (BLAINE COUNTY)[1]

Type of Collection and/or Habitat	Percentage for Each Species Found												
	Aedes campestris	Aedes dorsalis	Aedes idahoensis	Aedes increpitus	Aedes nigromaculis	Aedes spencerii	Aedes trivittatus	Aedes vexans	Anopheles earlei	Culex tarsalis	Culex territans	Culiseta inornata
LARVAL COLLECTIONS												
Off Field Water												
Temporary Water (2715 identified)	1	33	7	1	3	1	1	40	1	8	1	6
Semi-permanent & Permanent Water (1052 identified)		20	8		2		1	24	4	12	1	29
On Field Water												
Crop: alfalfa (1977 identified)	1	40	5	1	9	1	1	36		6		2
Pasture (1469 identified)		25	5		13	1	1	51		3	1	1
Bluejoint Meadow (385 identified)		25	14		1	1		58				
ADULT COLLECTIONS												
Light Trap		9			18			21		30		18
Biting		11	8		39			39				

The temporary water sources included roadside ditches, borrow pits, waste-land areas, abandoned canals, and laterals. Semi-permanent and permanent water sources included roadside ditches, borrow pits, drainage ditches, oxbows, and sloughs and the distribution system. Other species reported in this region include Aedes cinereus, Aedes flavescens, and Aedes malanimon (which was not distinguished from Aedes dorsalis in the survey).

[1]"Mosquito Investigations, Milk River Irrigation Project, Montana, with Particular Reference to the Causes of Mosquito Production in a Long-Established Irrigated Area Characterized by Flat Topography and Heavy Soils" (1953) Communicable Disease Center, U.S. Dept. of Health, Education, and Welfare, 53 pp.

Appendix IV

COMPARATIVE DATA UPON MONTANA MOSQUITOES

(Modified from Mail (1934) Mosquitoes of Montana, Bulletin 288, Montana State College Agricultural Experiment Station)

Species	Comparative Abundance *	Important Lowland Species	Predominately Mountain Species	Number Generations Per Year
Aedes campestris	3			
canadensis	3		X	1
cataphylla	4		X	1
cinereus	2			1
communis	3		X	1
dianteus	6		X	1 ?
dorsalis	1	X		1 to many
excrucians	4		X	1
fitchii	3		X	1
flavescens	3			1
hendersoni	6			several
hexodontus	4		X	1
idahoensis	1	X		
impiger	4		X	1
implicatus	4		X	1 ?
increpitus	1	X	X	1
intrudens	4		X	1
melanimon	1	X		1 to many
mercurator	6			1
nigromaculis	1	X		1 to many
pionips	5		X	1
provocans	6		X	1 ?
pullatus	4		X	1
punctor	4		X	1
riparus	6			?
schizopinax	5			1
sierrensis	5			1 to several, not all hatch at first flooding
spencerii	3			1 may be 2 or 3
sticticus	2			1, may be few smaller
trivittatus	2	X		several
vexans	1	X		1, all eggs do not hatch with each flood or some report several

* Comparative Abundance:
1, abundant; 2, common; 3, fairly common; 4, fairly rare; 5, rare; 6, very rare

Species	Comparative Abundance *	Important Lowland Species	Predominately Mountain Species	Number Generations Per Year
Anopheles earlei	3			several
freeborni	4			several
punctipennis	5			several
Culex pipiens	4			several
restuans	4			several
tarsalis	2	X		several
territans	5			several
Culiseta alaskaensis	3			1
m. dyari	5			1 ?
impatiens	4			1 or several
incidens	3	X		several
inornata	2	X		several
s. minnesotae	5			?

* Comparative Abundance:
1, abundant; 2, common; 3, fairly common; 4, fairly rare;
5, rare; 6, very rare